GEANT4 SIMULATION OF FAST NEUTRON INTERACTIONS IN HEAVY OXIDE SCINTILLATORS

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Abstract: Fast neutron detection is critical to the interdiction of illicit special nuclear material among other potential applications. The use of heavy oxide scintillators to detect fast neutrons is one technology requiring little to no moderation and enabling construction of highly efficient detectors. Previous work qualitatively describes various physical modes of neutron interaction in these materials. This work simulates the interaction of neutrons in heavy oxide materials in order to quantify the contribution of each physical mode to the overall detection signal and to evaluate the chain of reactions from incident neutron to optical photon production and transport. Such quantization may enable optimization of detector design and greater fidelity in detector response. Using GEANT4 in conjunction with Lawrence Livermore National Laboratory’s LEND physics list, we simulated the response of Bismuth Germanate (Bi4Ge3O12 or BGO) to incident neutrons. We validated the simulation by comparison to known data and laboratory experimental results. Optical photon production was generally a result of complex and highly varied series of particle interactions. Although we identified hundreds of unique photon production channels in BGO, relatively few such channels played a significant role in optical photon production. We observed that 90% of photon production was through a channel that started with an initial neutron elastic or inelastic scattering event.

EFFECTIVENESS OF LASER WEAPONS IN THE ENVIRONMENT OF SOUTHEAST ASIA

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Abstract: In recent years, Southeast Asia (SEA) has seen many of Islamic State's (IS) supporters returned home after fighting in the Middle East. The tactics and warfighting knowledge that they have learned, such as the making of homemade rockets and IEDs, could actually be applied in SEA as well, causing SEA to be a high potential as the next cauldron of violence. Damage was almost done in August 2016, when a local Indonesian terror group had planned to launch a rocket attack from Batam, Indonesia, at the Marina Bay Sands Resort in Singapore. This thesis will investigate the effectiveness of laser weapons in the tropical environment of Southeast Asia. Given the high rainfall rate and almost annual haze, the effectiveness of laser weapons against targets that IS had employed in the Iraq and Syria, in particular UAV and rockets, will be studied.